

Compressed Digital Video

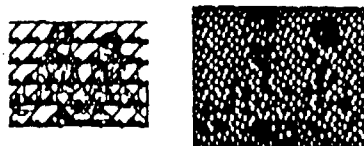
- **Compressed digital television systems are very different from analog systems**
 - they perform a more difficult job, so they are more complex and have a different structure
 - they are more like data communications than television (as we used to know it)
- **The use of compression firmly decouples transmission (data structures and bit streams) from production and display standards (pixels)**
- **A layered model (analogous to the “OSI model” of data communications) is a useful paradigm**
 - shows the inherent construction of a CDV system
 - identifies different levels where interoperability occurs

Digital Video Compression "OSI Layers"

Picture



Picture
Components



Codes



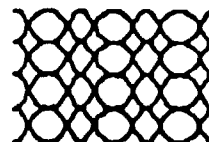
Packets



Bits

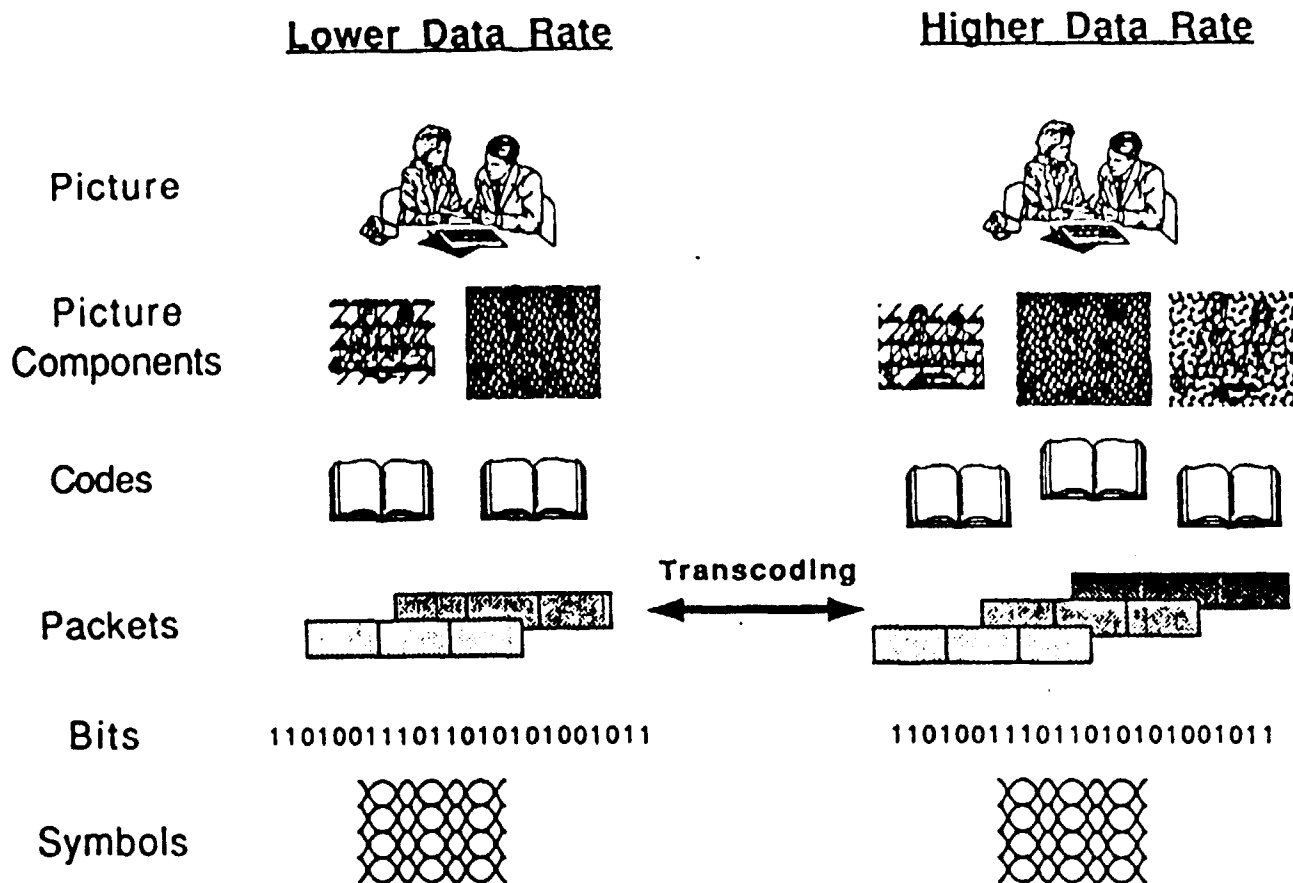
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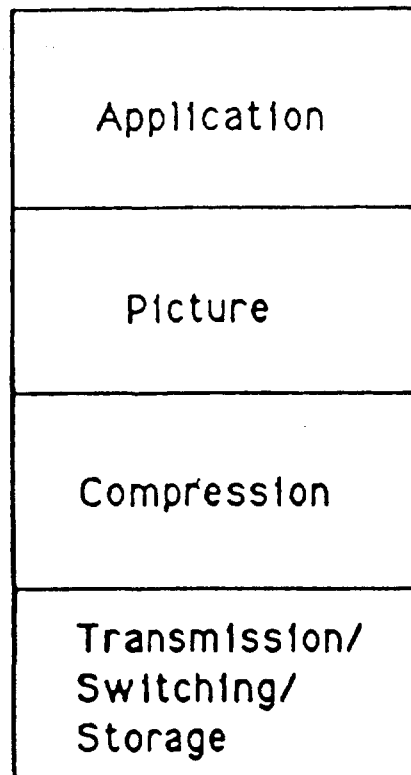
Symbols



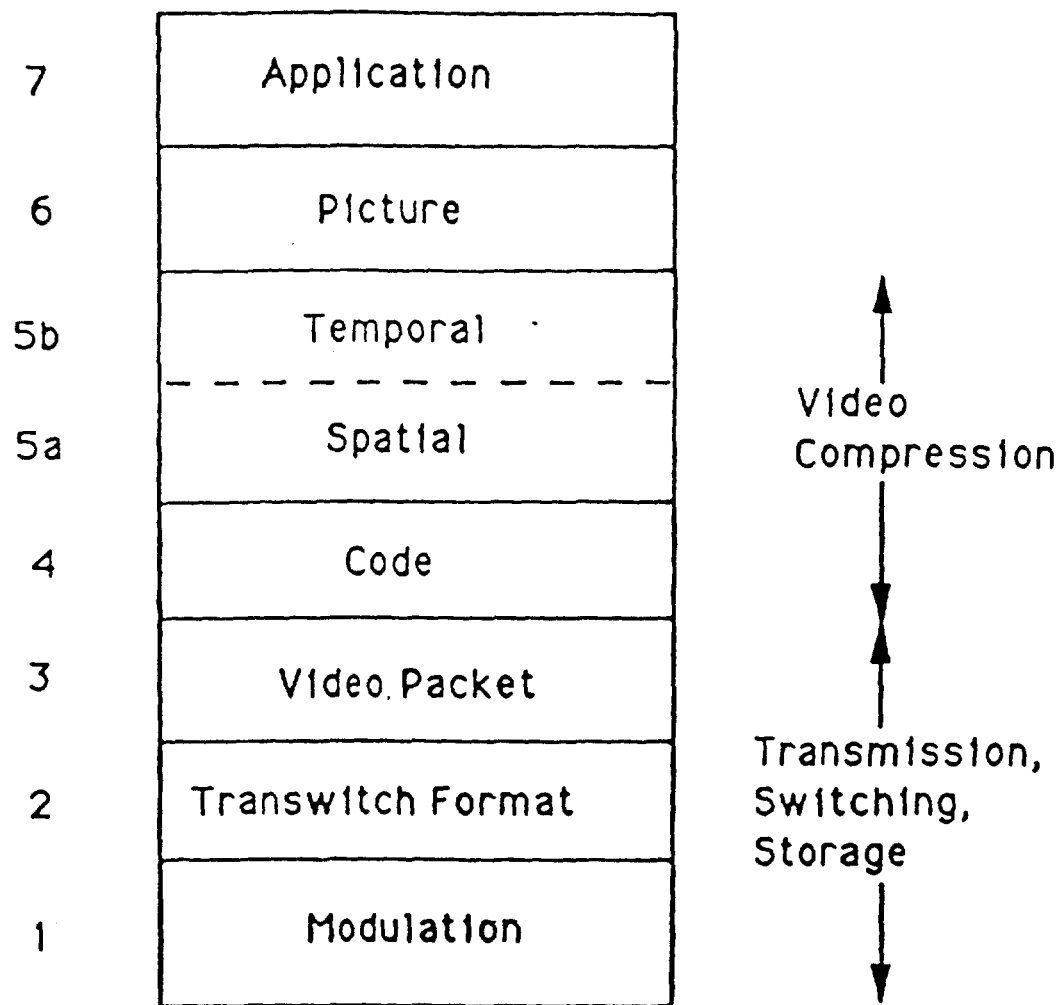
Transcoding

...Low-Level Transcoding Means Low Cost...





Digital Video Reference Layers



Digital Video Reference Sublayers

Video Reference Sublayer Functions

- Application : Broadcasting, videoconference, videophone, education, medical imaging, animation ...
- Picture : Raster parameters (CIF, QCIF, SIF, CCIR 601...) encryption
- Temporal : Filtering, subsampling, DPCM, motion compensation, 3-D subband
- Spatial : Transform coding, DCT, subband, pyramid, subsampling

Video Reference Sublayer Functions (Cont'd)

- Code : Variable length code, run-length code, arithmetic code
lossless coding
- Video packet : Frame structure for carrying video
information, error correction, handling priority
- Transwitching format:
Packet switching: BISDN (ATM), FDDI, LAN, MAN
Circuiting switching: SONET, DS1, DS3, ISDN, SWIFT
- Modulation : Depends on physical media, examples include
OOK, PSK, FSK, QAM

Timeline Deployment of Interoperable Functionality

Functionality



TV

1975

TV
Cable
VCR
Computer

1985

TV
Cable
VCR
Computer
DBS
CD-ROM
Video Telephone

1995

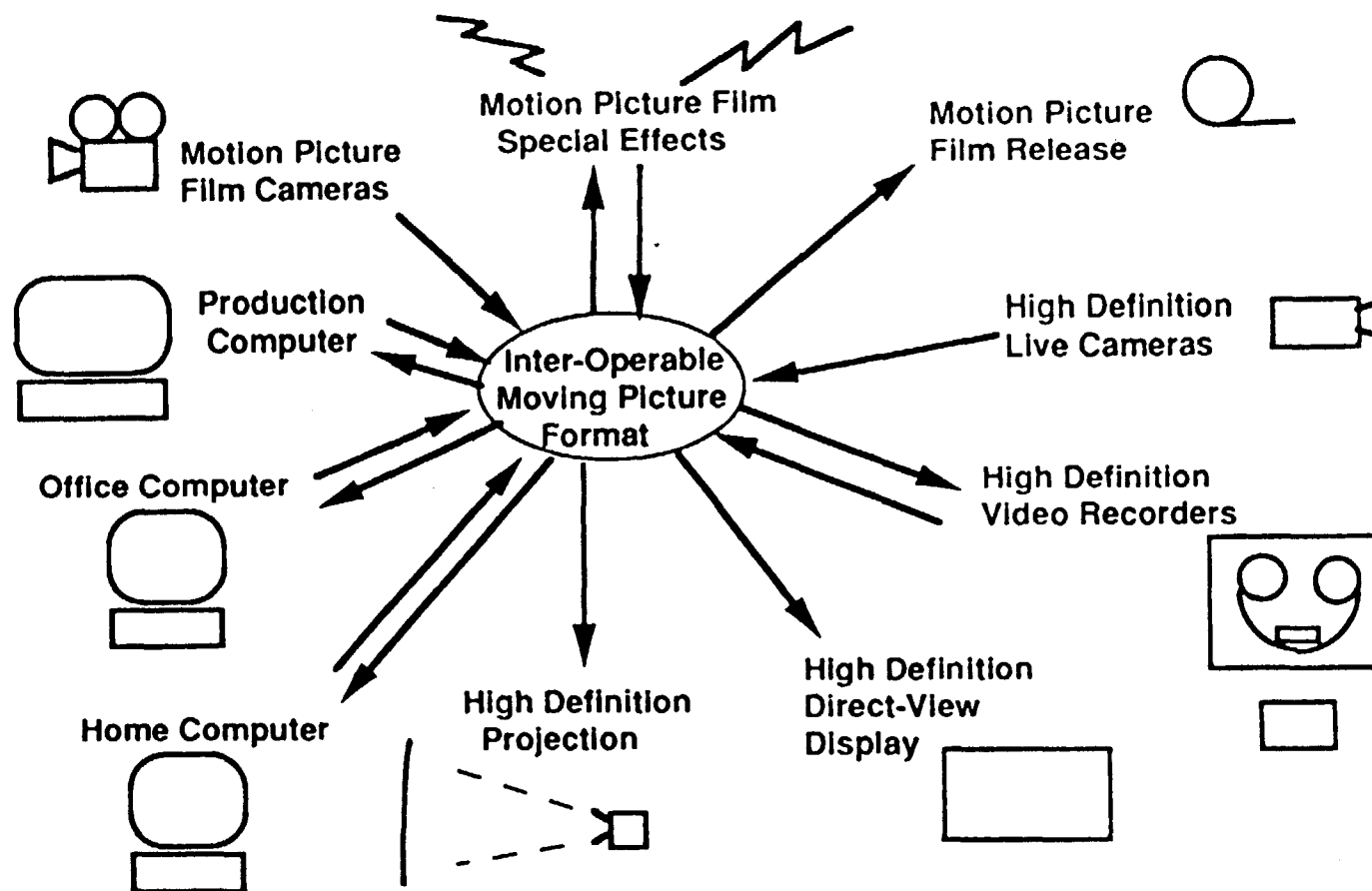
HDTV
Cable
VCR
Computer
DBS
CD-ROM
Video Telephone
Scientific, Medical images
Page Graphics
Integrated Compound Media

2000

Time

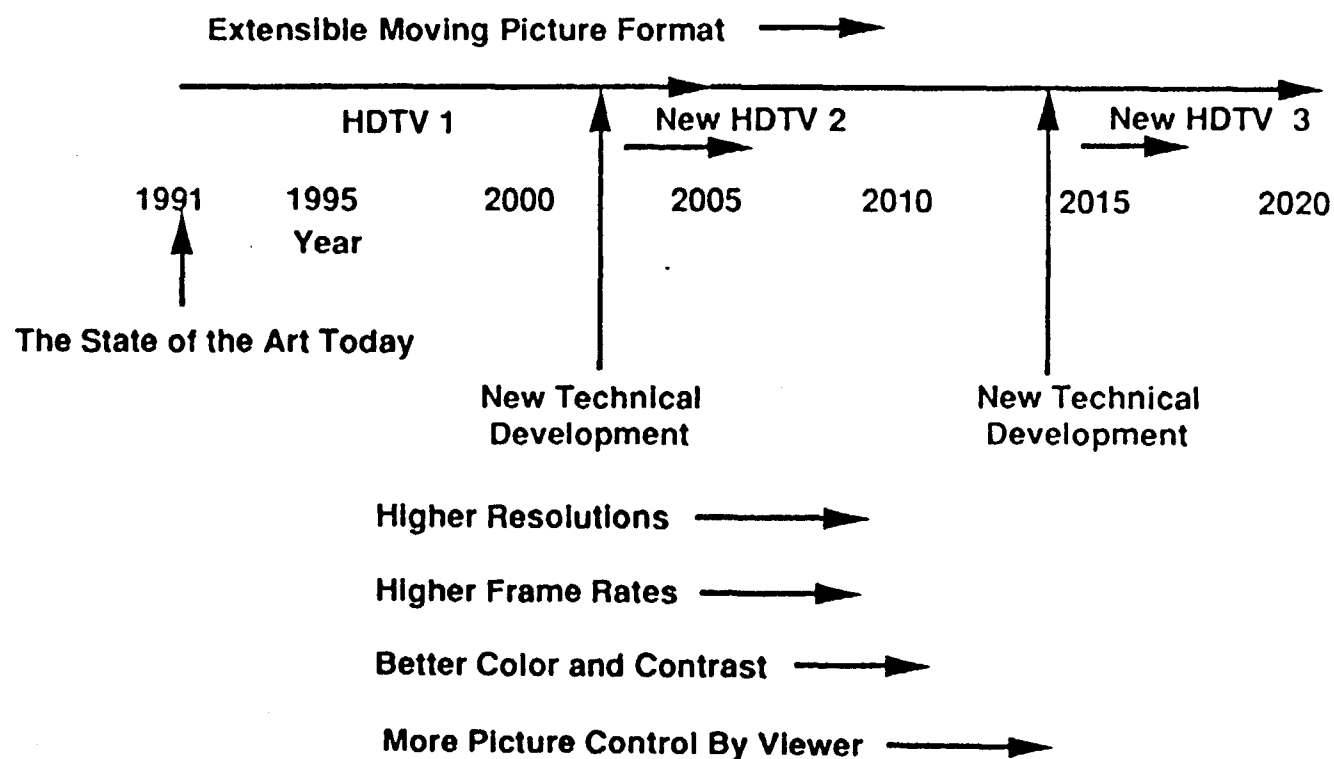
Inter-Operability:

The Ability of Devices To Work Together



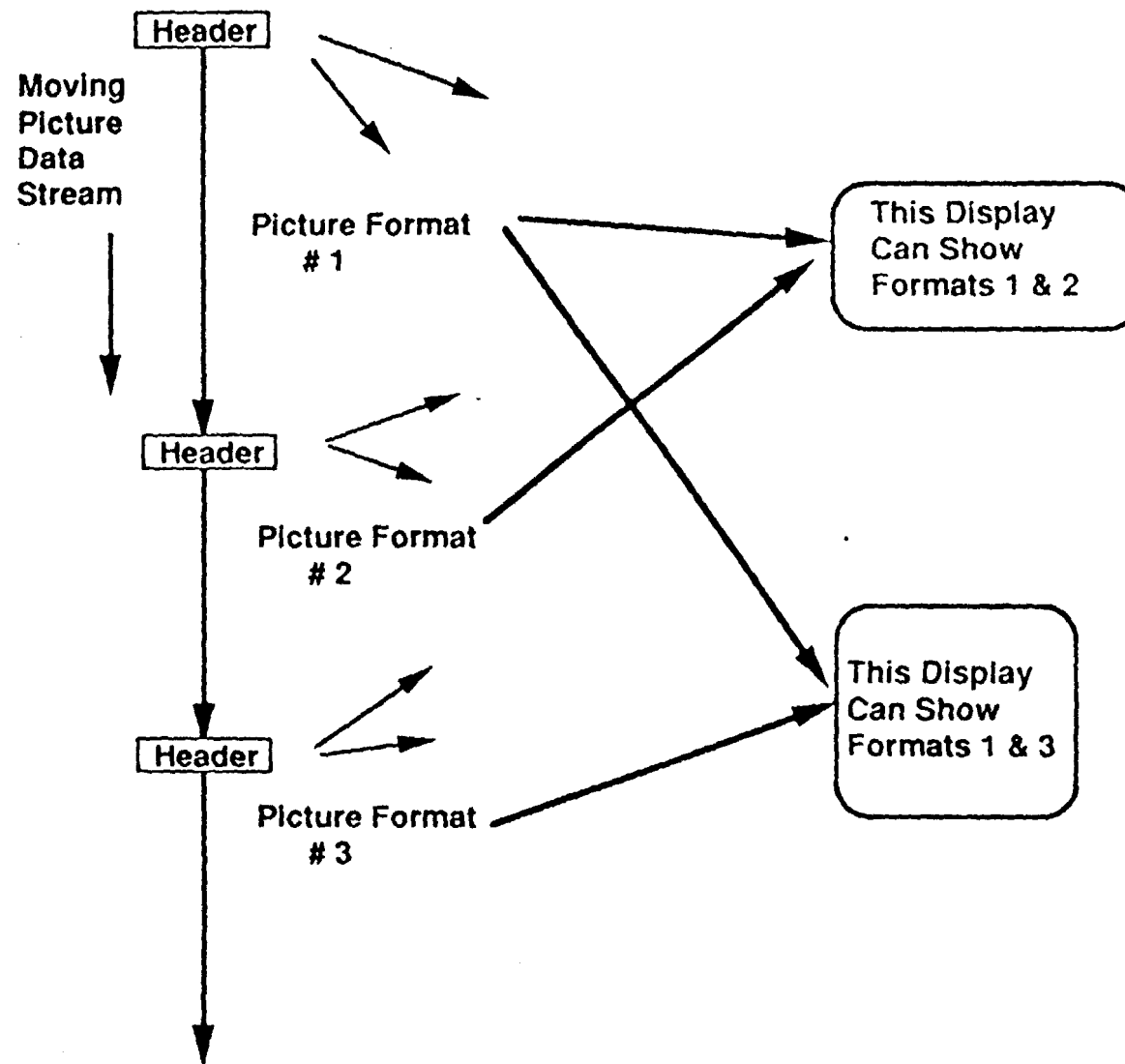
Extensibility:

The Ability of a Format to Advance With Technology



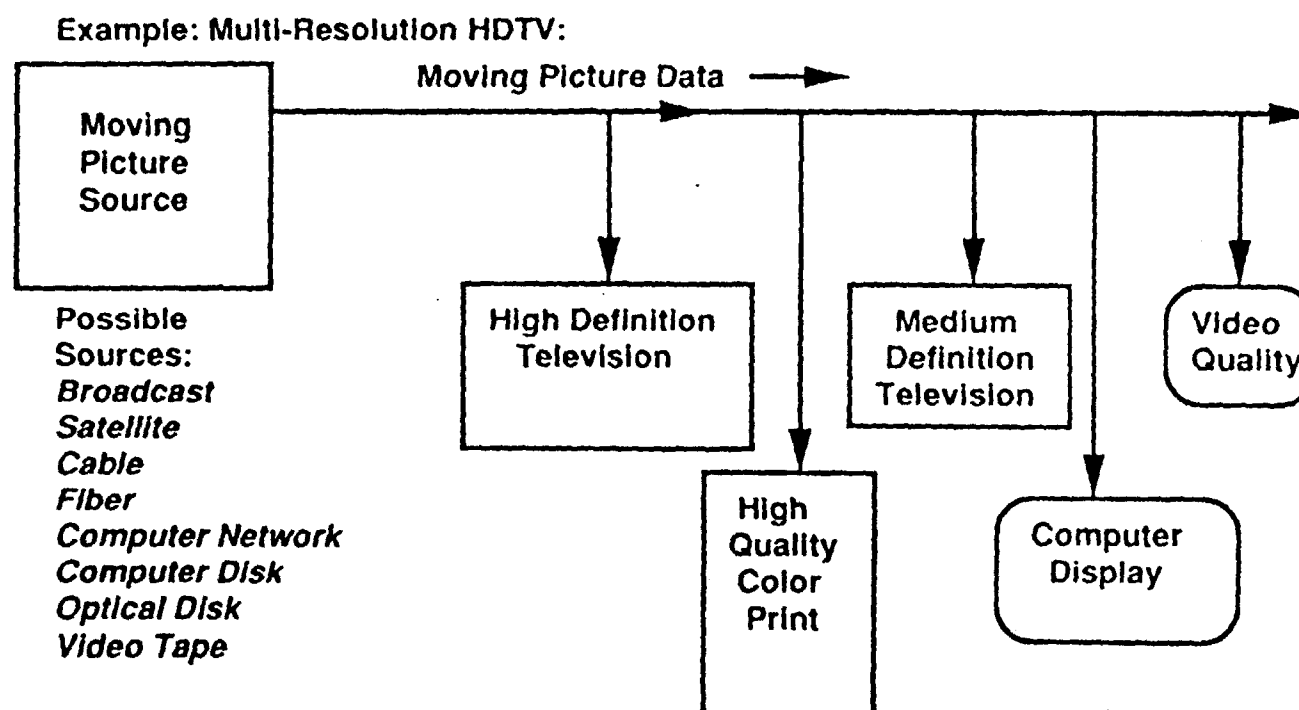
Universal Header:

Helpful In Interoperability, and Extensibility



Scalability:

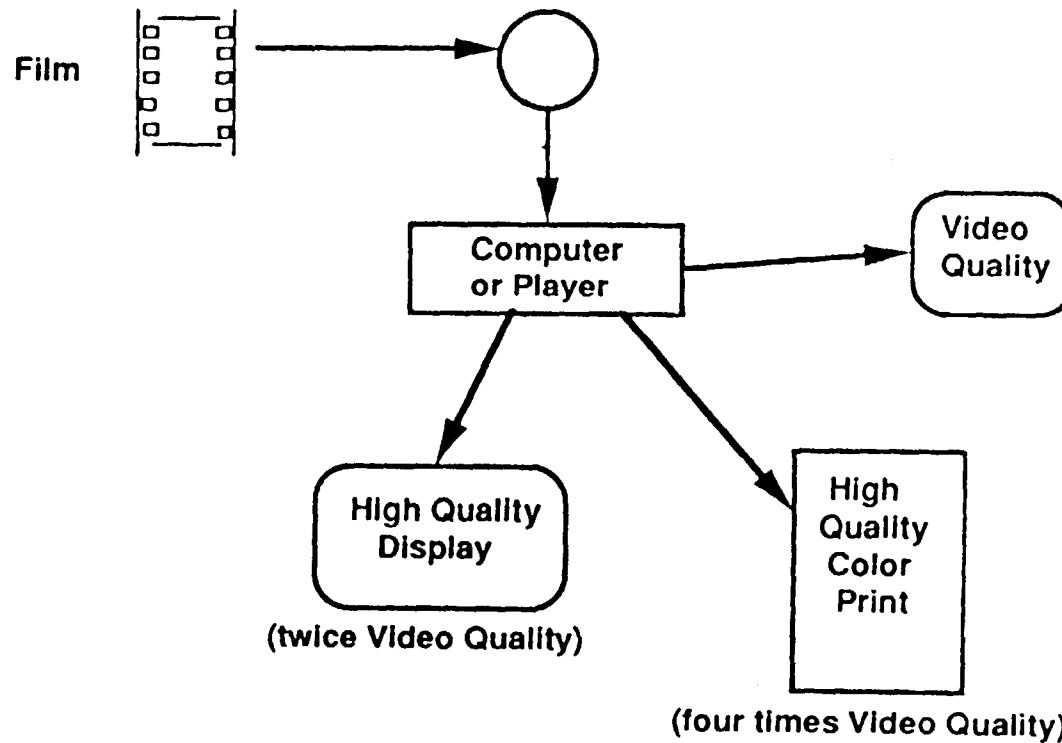
The ability to receive different resolutions and/or frame rates from a single moving picture format



Scalability:

The ability to receive different resolutions and/or frame rates from a single moving picture format

Example: Kodak Photo-CD



Attachment C: Headers / Descriptors.

12/29/91 20 191 19:14 818-354-0228

S.M.P.T.E.

P.2/2 10002

St13.21



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December 20, 1991

The Honorable Alfred C. Sikes
Chairman
Federal Communications Commission
1919 M Street NW
Washington, DC 20554

Subject: Notice of Proposed Rule Making; FCC 91-337
In the Matter of Advanced Television Systems and
Their Impact Upon the Existing Broadcast Service;
MM Docket #87-268

Dear Chairman Sikes:

The Society of Motion Picture and Television Engineers (SMPTE) wishes to inform the FCC, relevant to the subject NOPRM, of the ongoing work of the SMPTE Task Force on Digital Image Architecture (St13.20) and the SMPTE Task Force on Headers/Descriptors (St13.21).

These Task Forces, operating under the procedures of the SMPTE, the ANSI Accredited Standards Developer in the area of television production, are currently preparing recommendations for standards development to be considered by the SMPTE Standards Committee and its Technical Committees. The SMPTE Task Forces have considered, among other issues, questions of interoperability, extensibility and scalability of digital electronic images as they apply not only to television systems, but to other forms of electronic imaging. Thus, we believe that the Task Force recommendations and the resulting standards proposals will be of significant interest to the Commission in their deliberations on the subject NOPRM.

It is expected that the final reports of the SMPTE Task Forces will be considered at the February 6, 1992, meeting of the SMPTE Standards Committee. Upon their approval, the SMPTE will be pleased to forward these reports to the FCC for its consideration.

Sincerely,

Sherwin H. Becker,
Director of Engineering

cc: Blaine Baker
S. N. Baron

Attachment D: Minutes of Working Party 4 Meetings.

October 18, 1991 Meeting Minutes.

November 13, 1991 Meeting Minutes.

December 17, 1991 Meeting Minutes.

E Chairman's Report: Working Party 5

FIFTH INTERIM REPORT
of the
WORKING PARTY 5 ON ECONOMIC FACTORS AND
MARKET PENETRATION
of the
PLANNING SUBCOMMITTEE
of the
FCC ADVISORY COMMITTEE ON ADVANCED TELEVISION SERVICE

Rupert Stow.
Chairman, PS WP-5

February, 1992

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EXECUTIVE SUMMARY

Throughout the fifth work period, WP-5 worked closely with Systems Subcommittee Working Party 3 on Economic Assessment.

To meet the requirement to investigate the implications of ATV policy for industrial development and international trade, a Specialist Group was formed and a draft paper was prepared and submitted to the Chairman of the Advisory Committee.

The main focus of the work of the Working Party has been the refinement of the macro-economic projections for the adoption of ATV service, and specifically the rate at which ATV consumer equipment will penetrate the domestic market of television households. While PS WP-5 had previously presented two projections of market penetration, the recent impact of digital technology and the revised equipment costs becoming available, made a new projection essential.

This new and continuing work is based on a number of factors which are considered critical, and from which a range of assumptions may be made. These include:

- | the incremental value, as perceived by the consumer, of
ATV service over the present NTSC service,
- | the price of consumer equipment,
- | the availability of HDTV programming,
- | television station conversion costs,

| the impact of HD cable, home video, and satellite service,
| funds for the purchase of ATV equipment.

1. INTRODUCTION AND BACKGROUND

The previous projections of market penetration reported in the Fourth Interim Report have been widely, if somewhat intuitively, considered to be overly pessimistic. In part, this reaction stems from the more recent projections of lower prices for consumer equipment, and from certain efficiencies which may result from the switch to all-digital transmission of the ATV signal. Of even greater significance is the realization that the alternative media of cable and home video are well positioned to make an early penetration of the ATV marketplace, and could in fact offer service before the terrestrial broadcasting service is in full operation.

Accordingly, the present ongoing work of the Working Party 5 is concentrated on the development of a new penetration scenario, using some new assumptions in place of those used previously, and which are now found to be untenable.

Central to the projection of the market penetration of ATV is an assessment of the rate at which local stations will transition to ATV broadcasting. An earlier transition scenario by PS WP-5 is therefore being updated to take full account of the impact of all-digital transmission systems, and some new cost estimates that are now being developed.

Finally, it is likely that the tentative decisions incorporated in the FCC's Notice of Proposed Rule-making for ATV service will have a significant impact on the rate of conversion by local stations.

2. WORK STATEMENT FOR THE FIFTH PERIOD

PS WP-5 was required to perform the following work:

Working Party 5 was required to continue its macro-economic analysis as new factual data became available to refine and updated projections of the costs and the penetration of ATV equipment in consumers' homes.

As a part of the above work, the earlier transition scenarios for local stations converting to ATV service was to be updated.

The Working Party was also required to investigate the implications of ATV policies for industrial development and international trade.

3. PROGRESS REPORT

Throughout the fifth work period, the Working Party worked closely with the Systems Subcommittee Working Party 3, and four of the five meetings held were joint meetings with SS WP-3.

3.1 Implications for ATV Policies

To meet the requirement to investigate the implications of ATV policy for industrial development and international trade, a Specialist Group was formed and led by Robert Crandall, a Senior Fellow of the Brookings Institute, who joined WP-5 for this purpose. A draft paper was prepared, and was submitted to the Chairman of the Planning Subcommittee and to the Chairman of the Advisory Committee.

Essentially the findings were that any policy to be established for ATV should not be different from any policies established for the development of U.S. industry and the encouragement of U.S. exports in the whole field of electronics and telecommunications. In fact, the objectives would be best served by the establishment of an ATV terrestrial broadcast standard at the earliest possible time followed by the implementation of ATV service in the U.S. In particular, ATV offered excellent opportunities for U.S. employment in the production of ATV displays, which, because of their large size, would be manufactured in the U.S. Even today, almost all NTSC picture tubes of 25 inch diagonal or larger, are manufactured domestically.

While the paper sees little prospect for the mass export of ATV receivers, the opportunity exists for the sale of patent licenses overseas, if the present advances in digital compression technology by U.S. companies can be sustained in the face of international competition.

In summary, no specific policy can, in the near term, enhance the U.S. position, except the active prosecution by the FCC in the selection of a terrestrial broadcasting standard, and the creation of a regulatory environment which will encourage the early implementation of ATV service in the U.S.

3.2 ATV Market penetration

The main focus of the work of Working Party 5 has been, and continues to be, the refinement of the macro-economic projections for the adoption of ATV service, and specifically the rate at which ATV consumer equipment will penetrate the domestic market of television households.

The previous projections reported in the Fourth Interim Report have been widely, if somewhat intuitively, considered to be overly pessimistic. Indeed, a new assessment was clearly required to take account of the general shift to digital technology which calls for different equipment in the consumer's home. While the price of such equipment will initially be high, it is likely to fall very rapidly with the development of large scale integrated circuitry and the normal economies of scale.

In the development of the new penetration scenario, the following factors are held to be critical, and a range of assumptions are applied to each.